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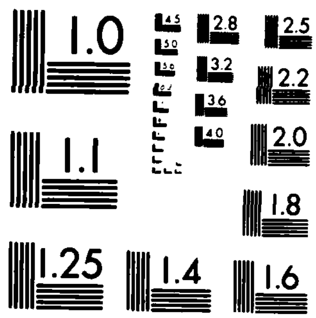

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Ground-based magnetometer data, recorded at AT&T Bell Laboratories' stations located at low to mid-latitudes (L=2-4) and AFGL stations (L=2-3), have been analyzed to search for associations between dayside Pc3-5 pulsations (15-240 second periods) and solar wind parameters measured by instrumentation on board the IMPJ spacecraft. The statistical analysis techniques used in the work (power spectral analysis, correlation analysis, multiple linear regression methods) have led to the discovery and quantification of

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relationships between hydromagnetic waves in the magnetosphere as manifested by magnetic pulsations and interplanetary parameters. Multiple linear regression (MLR) analyses showed that the most important interplanetary parameter controlling ground hourly magnetic energy (in the period range 60-240 seconds) was the solar wind speed. MLR analyses further showed that hourly magnetic energy in the 15-60 second period range was also controlled by the solar wind speed but more so by the interplanetary magnetic field (IMF) direction. The velocity dependence supports the idea of wave production at the magnetopause via the Kelvin-Helmholtz instability. These waves are later observed as magnetic pulsations on the ground. The IMF direction dependence supports the idea that waves produced at or near the Earth's bow shock are later observed on the ground as magnetic pulsations in the shortest period bands (15-60 seconds). This last conclusion is also supported by the results of the dynamic power spectral analyses that showed interplanetary compressional wave power (Pc3) transmitted to the ground prior to local noon.

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B. Research Objectives

1. Study correlations between ground-based magnetic pulsations in three period bands observed during local daytime and nighttime at Pittsburg, N.H. and interplanetary magnetic field and plasma during 28 days in 1975 (July 14-21, July 27 - August 2, August 7-12 and August 20-26).

2. Study correlations between ground-based magnetic pulsations in three period bands observed during local daytime with the AT&T Bell Labs north-south chain of stations (Girardville, Lac Rebours, Pittsburg, Durham and Siple) and with the AFGL east-west network (Sudbury, Mt. Clemens, Camp Douglas, Rapid City, Newport, Tampa and Lompoc) and interplanetary magnetic field and plasma during September 23-29, 1977.

3. Use of power spectra of geomagnetic field fluctuations to estimate the radial diffusion of energetic particles in the earth's magnetosphere.

4. Study correlations between the interplanetary quantity ϵ, devised by Akasofu, and the AE index during five substorms (November 3-10, 1973, January 22-29, 1974, April 16-23, 1974, June 7-14, 1974 and July 3-10, 1974) using multiple linear regression methods.

5. Study correlations between ground-based magnetic pulsations in four period bands (Pc3-5 range) observed during local daytime at AT&T Bell Laboratories portable magnetometer stations near L=2 and interplanetary magnetic field and plasma during the interval January 27-30, 1979.

6. Study correlations between ground-based magnetic pulsations in four period bands (Pc3-5 range) observed during local daytime at AFGL magnetometer stations near L=2 and L=3 and interplanetary magnetic field and plasma during the interval January 27-30, 1979 in order to compare and contrast the results from AFGL data to the AT&T Bell Laboratories data.

7. Use of multiple linear regression methods to select the most important interplanetary parameters affecting observed ground magnetic activity.

8. Use of dynamic power spectral analyses of the high time resolution interplanetary magnetic field to compare with ground spectra.

C. Status of the Research

1. The results of the statistical analyses performed on the above data sets have led to new and more quantitative relationships between magnetic pulsations and solar wind parameters. In particular, magnetic pulsation energy (observed at mid-latitude on

the dayside) in the period range from 30-240 seconds has been related to solar wind speed and kinetic energy flux density. Shorter period magnetic pulsation energy (observed at low and mid-latitude) in the range from 15-60 seconds has been related moreso to the direction of the interplanetary magnetic field. Dynamic power spectral analyses have been performed on geomagnetic data and interplanetary magnetic field data recorded on January 28, 1979. These analyses revealed sudden rises in Pc3 wave power in both the H and D components of magnetic field observed at low and mid-latitude stations during local daytime hours. Similar rises were calculated to occur simultaneously for interplanetary compressional Pc3 wave power from dynamic power spectral analyses of the high time resolution (1.28 second) IMF data. These results, calculated for different period bands within the Pc3-5 range obtained over a latitudinal extent (L=1.8-4.4) and occurring during a wide range of interplanetary conditions, have clarified the external sources and transmission processes responsible for dayside magnetic pulsation energy.

2. Estimates of the radial diffusion coefficient of energetic particles in the magnetosphere have been calculated using power spectra from magnetic field data recorded on August 13, 1974 at Siple, Antarctica; Lac Rebours, Quebec and Pittsburg, N.H.

3. Five magnetospheric substorms have been investigated to search for quantities in the interplanetary medium which control the auroral electrojet AE index. Akasofu and his co-workers have previously reported a high correlation between AE and the interplanetary quantity ϵ using hourly averages of the data. Our results have yielded improved correlations using the logarithm of ϵ and using a one hour time delay for AE with the respect to the interplanetary data. We have also found higher correlations for AE with the electric field given by VB_z than with ϵ. Similar results were obtained by analyses of the 28 days during July and August 1975 which was considered to be a time of medium geomagnetic disturbance.

D. Publications

1. Dependence of Hydromagnetic Energy Spectra on Solar Wind Velocity and Interplanetary Magnetic Field Direction, A. Wolfe, L. J. Lanzerotti and C. G. Maclennan, J. Geophys. Res., 85, 114-118, 1980.

2. Particle Diffusion in the Geomagnetosphere: Comparison of Estimates from Measurements of Magnetic and Electric Field Fluctuations, L. J. Lanzerotti and A. Wolfe, J. Geophys. Res., 85, 2346, 1980.

3. Dependence of Midlatitude Hydromagnetic Energey Spectra on Solar Wind Speed and Interplanetary Magnetic Field Direction, A. Wolfe, J. Geophys. Res., 85, 5977, 1980.

4. Hydromagnetic Wave Observations in the Vicinity of a Magnetospheric Plasma Density Gradient, L. J. Lanzerotti and A. Wolfe, J. Geophys. Res., 86, 2447, 1981.

5. ULF Geomagnetic Power near L=4,6 Relationship to Upstream Solar Wind Quantities, A. Wolfe and A. Meloni, J. Geophys. Res., 86, 7507, 1981.

6. On the Relationships between Interplanetary Quantities and the Global Auroral Electrojet Index, A. Meloni, A. Wolfe and L. J. Lanzerotti, J. Geophys. Res., 87, 119, 1982.

7. ULF Geomagnetic Power near L=4,7. A Conjugate Area Study of Power Controlled by Solar Wind Quantities, A. Wolfe, J. Geophys. Res., 87, 10,425, 1982.

8. Discussion of "A High Time Resolution Study of the Solar Wind-Magnetosphere Energy Coupling Function" by Akasofu, Carbary, Meng, Sullivan and Lepping; A. Wolfe, L. J. Lanzerotti and A. Meloni, Planet Space Sci., in press, 1983.

9. Hydromagnetic Field Line Resonance and Modulation of Particle Precipitation, L. J. Lanzerotti, T. J. Rosenberg, A. Wolfe and C. G. Maclennan, submitted to J. Geophys. Res., 1983.

10. Variations in Hydromagnetic Wave Frequencies At Low Geomagnetic Latitudes, L. J. Lanzerotti, C. G. Maclennan, A. Meloni, A. Wolfe, J. Bamber, and D. Venkatesan, plan to submit to J. Geophys. Res., 1984.

11. Dependence of Hydromagnetic Energy Spectra Near L=2 and L=3 on Upstream Solar Wind Quantities, A. Wolfe, A. Meloni, L. J. Lanzerotti and C. G. Maclennan, plan to submit to J. Geophys Res., 1984.

E. Associated Professional Personnel

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F. Spoken Papers presented at Meetings

1. American Geophysical Union, Fall 1978 meeting, paper SM90.

2. American Geophysical Union, Spring 1979 meeting, paper SM133.

3. American Geophysical Union, Fall 1979 meeting, paper SM150.

4. American Geophysical Union, Spring 1980 meeting, paper SM139.

5. American Geophysical Union, Fall 1980 meeting, paper SM20 and SM21.

6. American Geophysical Union, Spring 1981 meeitng, paper SM37.

7. International Association of Geomagnetism and Aeronomy, Fourth Scientific Assembly August 1981, papers G3.02 and G3.46.

8. American Geophysical Union, Fall 1981 meeting, paper SM42A-3.

9. American Geophysical Union, Spring 1982 meeting, papers SM21-29 and SM42B-3.

10. American Geophysical Union, Fall 1982 meeting, paper SM32B-06.

11. American Geophysical Union, Spring 1983 meeting, paper SM41B-02.

12. International Association of Geomagnetism and Aeronomy at IUGG XVIII General Assembly August 1983, papers 3H.11, 3H.21 and 3H.35a (3H.R1).

13. Istituto Nazionale di Geofisica, Rome, Italy, September 2, 1983, presented seminar.

G. ---------

H.

1. Attended the Air Force Geophysical Laboratories geomagnetic field workshop to discuss magnetic pulsations on a global basis, April 6-7, 1979. This initial visit to AFGL gave me an opportunity to

familiarize myself with the AFGL magnetometer network and to discuss my current and planned research goals including analysis of magnetometer data from the AFGL east-west chain.

2. Visited the Air Force Geophysical Laboratories to work on magnetic pulsations research, July 1-2, 1980. I obtained magnetometer data time plots from all available stations in the AFGL network which recorded data for the five time intervals under consideration.

3. Visited the Air Force Geophysical Laboratories to work on magnetic pulsations research, September 3, 1981. I obtained magnetometer data time plots from all available stations in the AFGL network which recorded data for the time intervals Jan. 25-30 and Feb. 6-10, 1979.